SUMMARY OF REMARKS AT PEA APHID CONFERENCE

Indianapolis, Indiana. December 27-28, 1937.

ILLINOIS

"Pea Aphid Control in Illinois, 1937."

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Experimental work on pea aphid control has been in progress in northern Illinois for the past three years. Work during 1937 was a continuation of that done during the past two seasons. The pea aphid appeared in pea fields rather late in 1937 as compared with 1936 but was numerous enough to cause serious damage in untreated fields. Experimental work was begun soon after the infestation became well established and was continued until the end of the growing season. The results obtained would indicate that this procedure is essential if we are to correctly evaluate any of the control methods now in use. This is due to the fact that differences in weather conditions, plant growth, and aphid development occur, all of which have an effect on the results obtained in experimental work or field operations.

It might also be stated here that the machinery used for the application of dusts, sprays, or vaporized nicotine all have an important effect on the results obtained from the use of any of the insecticides. This fact should be recognized in experimental as well as commercial aphid control operations.

Tests with spray materials.--Nicotine and rotenone bearing materials were the insecticides used in sprays for aphid control. In combination with these were various spreaders and wetting agents, as well as other materials that were thought to be worth trying. Most of our efforts, however, were spent testing the efficiency of the numerous wetting agents offered for use with derris and cube. Over 50 of these combinations and dilutions were tested in replicated plots. It was found from these that some of the best wetting agents were the poorest for use with derris or cube for aphid control on peas. More detailed laboratory tests will probably be necessary to find out why this difference occurred in field tests.

Results of experimental work in 1937 tend to verify results obtained in 1936 with both nicotine and derris or cube for pea aphid control. They further show that cube is as effective as derris, assuming that the rotenone and total extractives are approximately the same in both samples. Derris or cube with a rotenone content of 4% was effective for pea aphid control when used at the rate of 2 or 3 pounds per 100 gallons of spray, assuming that the spray was applied at the rate of 125 to 150 gallons per acre. Aresket (liquid) used at the rate of 1 to 600 was used as a standard for comparison with other spreaders.

Tests with rotenone bearing dusts.--A rather extensive set of dust trials was planned for 1937 following a limited amount of work on them during 1936. Most of the dusts were made up to contain 1% of rotenone, other ingredients being varied as desired. Variables included diluents, wetting agents, some suggested by Dudley and Bronson, and irritants such as nicotine and certain thiocyanates. Results with rotenone bearing dusts were variable in 1937 as was the case in 1936. In many cases the results were excellent, however, in certain instances they were far from satisfactory. These cases were not easy to understand but apparently the poor performance was due to some weather condition, such as absence of free moisture (dew or rain) on the plants. In spite of some very poor results obtained with rotenone bearing dusts we feel that they have sufficient merit to warrant recommendation with reservation.

Until we have more conclusive evidence available than was obtained this year, we in Illinois will not be in a position to recommend the use of wetting agents or irritants in dusts for use on peas.

Nicotine vaporizer.--Tests with the nicotine vaporizer were continued during 1937. Of all the methods tested, this one gives the most spectacular results of any. It gives a quick, positive kill that can be estimated within a short time after treatment. Under certain conditions this method can be depended upon to give the most complete kill of any method now in use. It has several disadvantages including the use of a heavy apron, and slow application.

Summary.--There are at least three methods for controlling pea aphids that have been tested and show sufficient merit to warrant recommendation. These are (1) spraying, (2) dusting, and (3) treatment with nicotine vaporizer. Each method has its advantages and disadvantages. That chosen for field use will depend upon size of fields, location of fields, availability of materials, machinery available, and personal preference.

MARYLAND

"Pea Aphid in Maryland."
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Maryland Agricultural Experiment Station, College Park.

In 1936, sprays containing derris and a wetting agent gave excellent control of pea aphid in Western Maryland. Further tests were conducted in 1937 using nicotine sprays and derris sprays. Eleven plots were used in these experiments. Each was 30 by 500 feet or approximately 1/3 of an acre. One and two applications of these materials at the rate of 100 gallons per acre were made as shown in the table. All plots received one application on June 23, about 10 days before blooming; and some received an additional application on July 3 when the blooms were beginning to appear.

Results of Field Experiments for Pea Aphid Control in Western Maryland

PLOT NUMBER	MATERIAL	NUMBER OF TREATMENTS	APHIDS PER TIP: June 22	June 25	July 3	YIELD SHELLED PEAS PER ACRE(lbs.)
1	Check					
2	Nicotine, ½ gal.-100 gal.	2	9	21	56	815
3	Nicotine, ½ gal.-100 gal.	1	8	19	42	760
4	Derris*,4 lb. plus Sodium Lauryl Sulphate, ½ lb.-100gal.	2	17	8	5	1543
5	Derris, 4 lb. plus Sodium Lauryl Sulphate, ½ lb.-100 gal.	1	13	7	5	1682
6	Derris, 2 lb. plus Sodium Lauryl Sulphate, ¼ lb.-100 gal.	2	8	8	1	1798
7	Derris, 2 lb., Sodium Lauryl Sulphate, ¼ lb.-100 gal.	1	7	8	11	1020
8	Check					
9	Derris, 4 lb. plus 1 pt. Orthex Spreader-100 gal.	2	15	16	17	1073
10	Nicotine Sulphate, 1 pt. plus 4 lb. soap-100 gal.	2	14	16	64	614
11	Derris, 1 lb. plus nicotine Sulphate, ½ pt. plus ½ pt. soap per 100 gal.	2	15	16	39	893
	Average Checks		23	28	142	446

*Active derris extractive material including Rotenone 8%.

The results of these experiments confirmed, in general, those secured in 1936. Plots treated with sprays containing derris and a wetting agent yielded considerably more shelled peas than either check plots or plots sprayed with nicotine.

During the 1937 season, a heavy aphid infestation in peas on the Eastern Shore of Maryland caused much loss to canners and farmers largely because of complete lack of equipment for treating pea fields. Before proper equipment and insecticides could be secured, aphids had already caused considerable damage. Emergency spray rigs constructed by several canners were usually ineffective.

Derris and Cube sprays, when properly applied, gave good results. Nicotine fumigation gave the most complete and quickest kill. Derris dusts seemed less effective than sprays, possibly because of improper application of dusts.

Natural enemies of many kinds were present. The fungus disease of aphids was the most effective and was responsible for the cleaning up of most of the infestations on the Eastern Shore around May 25.

MICHIGAN

"Pea Aphid in Michigan."

Ray Hutson,
Michigan State College, East Lansing.

Pea aphids were not as abundant in Michigan during 1937 as during the past 2-3 years. However, the comparatively light infestation developed in the normal season. As a usual thing pea aphids are becoming noticeable by May 30th.

Opportunity did not arise for extensive work, although we did apply sprays of cube and derris with a sulphated alcohol, nicotine sulphate plus a sulphated alcohol, dusts containing 1% rotenone as well as using a nicotine lime-dust and a nicotine vaporizer. Our results with these materials may be ranked in the following order of effectiveness: Vaporizer, nicotine dust, sprays, and rotenone bearing dusts.

It may be noted here that the nicotine dust and the nicotine vaporizer did not kill the aphid parasites. Syrphid, coccinellid, and hymenopterous parasites remained to mop up the aphids missed by the treatment.

NEW JERSEY

"A Summary of the Investigations on the Control of Pea Aphid, Illinoia pisi, in New Jersey, 1937."

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New Jersey Agricultural Experiment Station, New Brunswick.

The work on pea aphid control in New Jersey during 1937 may be divided into three phases as follows:

(1) Dust experiments on row peas.
(2) Small plot experiments.
(3) Experiments with vaporized oil sprays and derris root dusts applied from airplanes.

The pea aphid did little direct damage to the pea crop in New Jersey, but the aphid as a vector of pea mosaic was a serious problem. Pea fields in the vicinity of alfalfa or clover fields were seriously affected by mosaic, whereas, pea fields far removed from alfalfa and clover fields were less seriously affected by aphids and pea mosaic.

Due to the mosaic infections and the rapid increase in natural enemies, it was impossible to get significant yield records from the experimental plots, therefore, aphid mortality records were used as the index of control.

Large plot experiments.--In large plot dust experiments derris root dust with a conditioning agent, derris root dust without a conditioning agent, and 4% nicotine dust were compared. The derris root was diluted with talc to give 1% rotenone and 4% or more total extractives. The conditioning agent was used at the rate of 1%.

When the wind velocity and temperature were favorable at the time of application the 4% nicotine dust proved to be more effective than did the derris root dust mixtures. The derris root dust without a conditioning agent proved to be more effective than the derris root dust containing a conditioning agent. This was also true in a series of small plot experiments.

Small plot experiments.--A series of small plot experiments were conducted for the purpose of testing new insecticide combinations, to secure data on proper time to apply dusts in regard to moisture conditions and to determine the residual effect of derris dusts.

Derris dusts were applied to small plots during the middle of the day when the plants were dry, then the same materials were applied in the early morning while the plants were covered with dew. No significant differences could be noted in the kill of aphids between applications on dry foliage and wet foliage.

From the small plot tests no residual effects of derris root dust to pea aphid was noted. The aphid population, however, was depleted very rapidly by natural enemies.

Airplane sprays and dusts.--Preliminary experiments were conducted with vaporized oil sprays applied from an airplane. The oil, of course, contained an insecticide. The insecticides tested in the vaporized oil were nicotine, derris extract and pyrethrum extract. Mixtures of derris and pyrethrum extracts were also tested. The data from the experimental plots showed a kill of approximately 75% with some of the oil-insecticide combinations.

Derris root dust applied from an airplane proved totally unsatisfactory as a control for the pea aphid.

Natural enemies of the pea aphid.--During the first week in June the natural enemies almost depleted the aphid population in southern New Jersey area. The natural enemies involved were fungi, syrphid fly larvae, lady beetles, Chrysopid larvae and Hymenopterous parasites.

It was observed that derris root dust destroyed large numbers of lady beetles and syrphid fly larvae.

NEW YORK

"Experiences with Pea Aphid Control in New York - 1937."
Hugh Glasgow,
New York Agricultural Experiment Station, Geneva.

The pea aphid outbreak in New York during 1937 was decidedly erratic in its behavior, being characterized by a much slower build-up early in the season than common, followed by a short period of rapid increase which was then succeeded by an early and spectacular decline in the aphid population shortly after the peak was reached.

The irregular course taken by the infestation appears to have been brought about in large measure by the weather that prevailed the forepart of the season, marked as it was by repeated rains which appeared to slow up the natural increase of the insect and at the same time hastened the development of the entomogenous fungus which in turn brought about the rapid falling off in numbers that occurred a week or more earlier than normally would have been expected.

Although an elaborate series of field experiments were planned and carried out during 1937 designed to throw some light on the relative merits and general practicability of the various control measures that are now available to the canners of the state, the final results were in general inconclusive owing to the early disappearance of the insect.

While a number of fields under experimentation did show noteworthy increases in yield due to the treatments, such increases in some cases being as much as a half ton or more of shelled peas per acre, such results were not the rule, the very same treatment in other fields and under slightly different conditions actually resulting in clear-cut decreases in yield instead of the increases that would naturally be expected to follow the careful application of proven control measures.

Population counts carried out periodically during the season made the reason for these discordant results perfectly clear. In many cases the aphid population was found to remain stationary as to increase for only a relatively short time following treatment, while in others the natural decline had actually commenced by the time the treatments were applied. As a result, the untreated portions of such fields, being soon practically freed from aphids by natural causes, rapidly outgrow any early injury they may have suffered, and in many cases developed normal crops. In the case of the corresponding treated sections, on the other hand, even though the measures applied resulted in many cases in completely freeing the plants of aphids immediately, the wheel damage from the machinery used resulted, as might be expected, in an appreciable decrease in yield.

This situation naturally made it exceedingly difficult to properly evaluate the different methods of control being tested on the basis of yield records, and since yields in most cases were of little significance, the only conclusions that could be drawn from much of the field work this season were necessarily based on the mortality records that were taken at the time of or shortly after treatments were applied.

Since it is obviously unsafe to base far-reaching field recommendations on results of this character, illuminating though they may be in some regards, we do not feel in a position to pass final judgment on some of the newer methods such as the use of rotenone bearing dusts or insecticides applied by the principle of atomization even though some of these unquestionably hold a great deal of promise.

In the case of the rotenone bearing dusts, for example, the initial kill was often surprisingly good, but the fact that this kill was not always as consistent or as uniformly high as where either rotenone sprays or nicotine preparations were used was somewhat disturbing. Furthermore, since we have no way of telling what the residual action of some of the newer insecticides may be and how they are likely to carry through the season in the face of a severe, persistent outbreak of the aphid, we are inclined for the present to place more reliance in some of the older methods of control, such as the rotenone sprays or nicotine preparations, even though some of the newer methods do have very obvious advantages as regards ease and rapidity of operation, and in the case of airplane applications the elimination of the mechanical injury that unavoidably accompanies the use of all ground machines.

UTAH

"Pea Aphid Control in Utah 1937."
George F. Knowlton,
Utah Agricultural Experiment Station.

Nicotine vaporizer.--Fumigation with a nicotine vaporizer killed approximately 99 percent of the aphids in fields examined before and after treatment. Dispersal of pea aphids from large acreages of nearby alfalfa and untreated peas often resulted in fields becoming reinfested soon after treatment.

Sprays.--Ground cube and derris root gave good control as a spray when diluted at the rate of 3 pounds of 4 percent rotenone bearing dust (or equivalent) to each 100 gallons of water, to which a liquid spreading and wetting agent was added. "Agicide" semi-fluid spray concentrate also was effective, no significant difference in control being noted between applications at strengths of 1:50, 1:100, 1:150; and 1:200.

Dusts.--Cube and derris dust mixtures containing 1 to 2 percent rotenone usually gave good control, but the results were less consistent than the derris and cube spray treatments.

Biological control.--Studies of the effectiveness of syrphid fly larvae and ladybird beetles as control factors in northern Utah pea fields were undertaken.

WISCONSIN

"Pea Aphid Control Experiments of 1937 in Wisconsin."
J. E. Dudley, Jr. and T.E. Bronson.
Bureau of Entomology and Plant Quarantine.

The plan of research experiments for the season of 1937 at the Madison, Wisconsin field station of the Bureau of Entomology and Plant Quarantine called for one large experimental plot of 14 acres, located at Waunakee, Wisconsin, where the experiments were conducted in cooperation with the Waunakee Canning Company and several other agencies. It was so arranged that the plot was entirely under the management of the laboratory force from planting to harvest, except that the canning company field man determined the time the peas should be cut.

In addition to this principal plot, as many experiments as time permitted were to be staged on farms controlled by the Waunakee Canning Company and other canning companies.

The experimental plot included 24 half-acre plots sowed broadcase, which were treated with five different materials, each treatment and a check replicated four times. The two remaining acres were devoted to small plot tests and general tests.

All the plots were planted from May 11 to 13 with a strain of wilt-resistant Perfection seed. Records were made of the previous history of the land, the rate of planting, the final stand of plants in each plot, and the presence of nitrogen-fixing bacteria nodules on the roots of plants in each plot.

The aphid was very scarce in three alfalfa fields adjoining the experimental plot, and the infestation in peas was light until the middle of June.

Control operations were commenced June 16 with one test. Rain and wet ground interrupted further tests for several days. The treatments and the results of treatment upon aphid reduction and upon yield are presented in table I: (See page 9)

An unexpected heavy growth of weeds occurred in some plots and not in others. All of eight individual plots and part of four others became overgrown with weeds. It is of interest to note that the area of weed growth corresponded exactly to the experimental plot of 1935, when a rank growth of weeds which came up after the peas had been cut was allowed to go to seed. A graph showing how the growth of weeds affected yields in the different plots is presented in table II: (See page 10)

RESULTS OF EXPERIMENTS WITH SPRAY, DUST, AND VAPORIZATION IN 24 HALF ACRE PLOTS
Each treatment replicated four times.
Waunakee, Wisconsin, May-July, 1937.

Treatment and other data	Amount per acre and other data	Plot	Percent reduction of aphids on different days			Yield in lbs. shelled peas per acre	Percent increase in yield
			2 or 3	6 or 7	15 or 16		
Derris spray	150 gallons	Half weedy	93	89	0	1725	58.5
Derris 0.01% rotenone	Traveled 2½ mi. per hr.	Not weedy	94.4	91.2	27	1386	0
Sodium oleyl sulphate 1-1500	Pressure 150 pounds	Weedy	97	95.3	83	966	64
Treated June 16	33 ft. boom with	Not weedy	89	90	0	2080	34.7
Harvested July 15	64 nozzles	Ave.	93.3	91.4	27.5	1539	28.5
Nicotine dust	50 pounds	Weedy	55	71	16	405	0
Nicotine sulphate 40% - 10%	Traveled 2 mi. per hr.	Not weedy	89	71	57	1654	5.5
Mono. copper sulphate 10%	21 ft. boom boxed in	Half weedy	66	68	0	924	0
Treated June 21	100 ft. trailer	Not weedy	60	35	70	1260	0
Harvested July 15	Self-mixing duster	Ave.	67.5	61	36	1061	0
Derris dust mixture	33 pounds	Weedy	92	96.8	62	1256	143.5
Derris-talc 1% rotenone	Traveled 2½ to 3	Not weedy	89	95.3	77	2617	67
Sodium oleyl sulphate 1%	mi. per hr.	Weedy	89	98.5	66	1703	157.5
An aliphatic thiocyanate 1%	24 ft. boom boxed in	Not weedy	96	95.8	51	2712	79
Treated June 21	25 ft. trailer	Ave.	91.5	96.6	64	2072	94.5
Harvested July 17							
Derris dust mixture	34 pounds	Weedy	91	96.3	84	1100	87
Derris-talc 1% rotenone	Traveled 2 mi. per hr.	Not weedy	91.4	97	74	2609	69
Sodium oleyl sulphate 1%	24 ft. boom boxed in	Weedy	89	94.3	59	1269	115.5
Treated June 22	25 ft. trailer	Not weedy	94.4	96.3	89	2715	73
Harvested July 17		Ave.	91.4	96	76.5	1923	79.5
Nicotine vapor	3-1/3 pounds	Half weedy	91	91.7	74	1458	34
Free nicotine 80%	Traveled 1¼ mi. per hr.	Not weedy	93.5	91.7	29	1877	23.5
	18 ft. boom boxed in	Weedy	73	88	40	1076	108.5
Treated June 22	100 ft. trailer	Not weedy	91.4	92.3	75	2118	35
Harvested July 16 & 17		Ave.	87	90.9	54.5	1632	39
Check - Untreated		Weedy				516	
		Not weedy				1569	
		Half weedy				1088	
Harvested July 15 & 16		Not weedy				1518	
		Ave.				1173	

GRAPH OF REPLICATED HALF ACRE PLOTS SHOWING EXTENT OF HEAVY WEED GROWTH WHICH GREATLY AFFECTED YIELDS.
WAUNAKEE, WISCONSIN, MAY-JULY, 1937.
Plots Averaged 467 Feet Long by 48 Feet Wide or .515 Acres Each.

	Plot 13 Check	Plot 14 Derris dust 6/21	Plot 15 Derris spray 6/16	Plot 16 Nic. vapor 6/22	Plot 17 Derris dust 6/22	Plot 18 Nic. dust 6/21	Plot 19 Check	Plot 20 Derris dust 6/21	Plot 21 Derris spray 6/16	Plot 22 Nic. vapor 6/22	Plot 23 Derris dust 6/22	Plot 24 Nic. dust 6/21
	28' 20'	Heavy growth of weeds corresponding exactly to experimental plots of 1935 where weeds were allowed to go to seed.				20' 28'	Few or no weeds in rest of plots, including over half of plots 13 and 18.					
Yields per acre in non-weedy and weedy parts --	1513 662											
Yield - pounds of shelled peas per acre --	1088	1703	966	1076	1269	924	1518	2712	2080	2118	2715	1260

	Plot 1 Nic. vapor 6/22	Plot 2 Derris dust 6/22	Plot 3 Nic. dust 6/21	Plot 4 Check	Plot 5 Derris dust 6/21	Plot 6 Derris spray 6/16	Plot 7 Nic. vapor 6/22	Plot 8 Derris dust 6/22	Plot 9 Nic. dust 6/21	Plot 10 Check	Plot 11 Derris dust 6/21	Plot 12 Derris spray 6/16
	28' 20'	Heavy growth of weeds corresponding exactly to experimental plots of 1935 where weeds were allowed to go to seed.				20' 28'	Few or no weeds in rest of plots, including over half of plots 1 and 6.					
Yields per acre in non-weedy and weedy parts --	2004 910											
Yield - pounds of shelled peas per acre --	1458	1100	405	516	1256	1725	1877	2609	1654	1569	2617	1386

The apparent effect of this weed growth upon the results of the treatments varied. The reduction in the infestation resulting from treatments with nicotine dust and nicotine vapor was less in the weedy plots than in the non-weedy plots while the derris spray and derris dust treatments resulted in no significant difference in the reduction in infestation when the two types of plots were compared.

The effect of weed growth upon yields was pronounced and varied in comparable plots by over 100 percent.

The percentage of increase in yield, however, in nearly every instance was much greater in the weedy plots than in the non-weedy plots.

The other group of experiments conducted on farms of three different canning companies was not replicated. The first experiment comprised cube spray with a spreading and wetting agent, of 0.01 percent rotenone content, applied June 18, nicotine vapor derived from 80 percent free nicotine applied June 22, and derris-talc dust conditioned with a spreading and wetting agent, the final mixture containing 0.75 percent rotenone, applied also on June 22. These materials were applied with the same apparatus and at the same rate per acre as in the first experiment. In two, six, and fifteen days after treatment the several treatments reduced the infestation as follows:

Cube spray:	95% - 95% - 66%
Nicotine vapor:	84% - 63% - 60%
Derris dust:	97% - 98% - 86%

It was evident that the nicotine vapor and derris dust mixture were applied a little late for the most profitable control of the aphid, because the infestation began to dwindle in the check in this field soon after the other plots were treated.

When the plots were harvested on July 13, the yield of each treated plot in pounds of shelled peas per acre and the percent of increase over the check were:

Cube spray:	1016 pounds - 36%
Nicotine vapor:	823 pounds - 10%
Derris dust:	980 pounds - 31½%

Eight other tests with derris dust were staged in this experiment. The rotenone content of the final mixtures was either 0.75 percent or 1 percent, but the conditioning agents employed and the quantities of dust applied per acre varied in the different tests. In all instances the reduction in the infestation amounted to 90 percent or over in two or three days and eventually rose to 95 percent or higher. No further yields were taken.

A second experiment staged in the field of a canning company included two tests with cube dust mixture of 0.75 percent and 1 percent rotenone content, applied at the rate of 40 pounds per acre. The reduction in the infestation was extremely close in both tests, averaging 93 percent after two days, 93½ percent after five days, and 96½ percent after eight days.

A third experiment in the same location consisted of eight tests wherein derris or cube dust mixtures with a final rotenone content of 0.75 percent and 1 percent were applied. Again the conditioning agents and the quantity of dust applied per acre varied. The reduction in the infestation ranged from 79 percent to 95 percent after three days, from 89 percent to 96½ percent after seven days, and from 90½ percent to 96 percent after 16 days.

A fourth experiment comprised six tests in which derris or cube dust mixtures with a constant rotenone content of 0.75 percent were applied. The quantity applied per acre varied in the different tests. The reduction in the infestation ranged from 92 percent to 96 percent after three days and from 96 percent to 98 percent after five days.

Finally, a fifth experiment was staged in a canning company field in north-central Wisconsin comprising ten tests wherein derris dust mixtures with a rotenone content of 0.5 percent, 0.75 percent, and 1 percent were applied. The conditioning agents and the quantities of dust applied per acre varied in the different tests. The reduction in the infestation in 38 hours after treatment ranged from 90 to 99½ percent.

Summary.--In a large replicated plot experiment satisfactory aphid control was secured by treatment with derris spray, derris dust mixture, and nicotine vapor, but not with nicotine dust. The largest increase in the yield of shelled peas resulted from the derris dust treatments, with the nicotine vapor treatment second, and the derris spray treatment third. The plots treated with nicotine dust yielded less than the checks.